MEMORANDUM
RM-5285-PR
SEPTEMBER 1967

DEFENSE PROCUREMENT AND PUBLIC UTILITY REGULATION

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PREPARED FOR:
UNITED STATES AIR FORCE PROJECT RAND

The RAND Corporation
SANTA MONICA • CALIFORNIA

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This research is supported by the United States Air Force under Project RAND—Contract No. F44620-67-C-0045—monitored by the Directorate of Operational Requirements and Development Plans, Deputy Chief of Staff, Research and Development, Hq USAF. Views or conclusions contained in this Memorandum should not be interpreted as representing the official opinion or policy of the United States Air Force.

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PREFACE

This Memorandum is part of RAND's continuing program of procurement research. In one sense, all parts of the procurement research program are concerned with regulation. This study, however, seeks to examine the application of general regulatory concepts to the defense industry. Current regulation of defense contracts is compared with a more traditional form of public control on entrepreneurial behavior -- public utility regulation. Finally, the study considers the relevance of the public utility model as a solution for our procurement problems.

SUMMARY

This Memorandum compares the regulation of public utilities and of defense contractors. Since both systems base their prices on costs, their regulation involves similar problems of controlling perverse managerial incentives. The two systems also differ significantly. In the procurement system the contractor's fee is based on the total cost of producing an item; public utility profits are based on the firm's contribution of an input -- capital. This difference poses contrasting sorts of control problems for regulators. In the public utility sector, the major control problem is to prevent overinvestment. In procurement, basing profits on total costs gives the contractor a more general incentive to increase costs; all cost elements are likely candidates for inflation.

The study investigates various specific control problems. It is concluded, after an examination of the control of operating expenses, that the basic regulatory problems are inherent in cost-based prices. These problems do not appear remediable by contracting practices such as incentive fees, profit rate differentials, and improved cost estimation techniques.

The study examines two theories relating to procurement cost control. One is that contracts will be "loaded" with personnel and other direct expense inputs. These inputs may not contribute notably to the project in hand, although they increase the firm's capabilities and reputation and thereby help it obtain future work. The second is the current worry that overhead costs will grow unduly high. Two conclusions emerge. The first is that undue growth in direct expenses is as likely as undue growth in indirect costs. The second is that control of overhead costs by contracting separately for the two kinds of costs would necessitate control over the contractor's shifting expenses between categories according to his decisions about the type of inputs to use in the production process. Such shifting could result in lower overhead costs but higher system costs.

The desirability of applying the public utility concept to procurement is also considered. Such an innovation would mean changing the

fee base for weapon system manufacture from total costs to investment. The conclusion is that such a shift would be illogical. The preference for private rather than public management of the development and manufacture of weapon systems does not hinge on a preference for private investment. Nonetheless, a serious drawback to our present profit system is the lack of a clear link between the performance we seek to motivate and the fees defense contractors earn.

A public utility type of regulation does not offer a solution to the problems of procurement regulation. Instead of intensifying regulation, it seems much more promising to minimize the need for it. This will require changes in weapon system acquisition strategy, in which case innovations in acquisition procedures, such as total-program-package procurements and second-sourcing may have great significance.

ACKNOWLEDGMENTS

The author wishes to thank T. K. Glennan, Jr., L. L. Johnson, R. E. Johnson, R. R. Nelson, J. R. Schlesinger, and L. A. Staszak for their comments and advice. Special thanks are due I. N. Fisher and Linda J. Kleiger for suggestions and counsel.

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I. INTRODUCTION

This Memorandum examines the economic conditions that have led to Government regulation of defense contractors, some features of this regulation, and some similarities and differences between the regulation of defense procurement and the more conventional type of business regulation. Since most regulated firms, including large defense contractors, use cost-based prices, most regulatory systems share many of the same problems. Procurement differs, however, in that profits are based on total cost, not on the firm's investment. This creates different managerial incentives and regulatory tasks from those found in most other regulated areas.

Possibly substituting a public utility type of regulatory system for present procurement controls is examined. The thesis presented is that the public utility model provides little assistance to procurement policymakers. Public utility regulation has emphasized the elimination of monopoly rents by assuring that the regulated firms earn only a "fair" profit. The major problem in procurement is determining efficient target costs for weapon systems and linking fee policy to the contractor's behavior. Public utility regulation has been least successful in dealing with such problems. Thus, rather than moving to the more thoroughgoing regulation of the public utility type, a more promising direction for procurement policymakers might lie in modifying weapon system acquisition procedures in order to lessen the need for direct regulation.

The next section discusses the reason for regulating defense procurement and how this regulation is organized. Section III considers price determination in the procurement area and contrasts this with more conventional price determination under regulation. Section IV considers the problem of cost control. The final section summarizes the conclusions.

II. THE ORIGIN AND ORGANIZATION OF PROCUREMENT REGULATION

Viewed broadly, a business regulation system is a set of arrangements, laws, and institutions influencing or constraining entrepreneurial decisions. In this sense, competition is the most important regulatory system in the United States. The term regulation, however, frequently refers to a specific type of business control system, one that substitutes direct governmental cognizance, supervision, or control for free market forces. This narrower usage is followed here. The purpose here is to distinguish and compare two different types of direct regulation -- the system currently used to control contractors and the more traditional regulation applied to the public utility sector.

Before going into the similarities and differences between the two regulatory systems, it should be noted that defense contracting is an area where both competition and direct regulation have been relied upon to protect the public interest. It is a firmly established public policy that, where possible, contractors for military items will be selected through price competition.* When price competition is not obtained, the Government exercises extensive direct control over contractor's activities.

The relative roles of competition and direct regulation have varied over time. During the mobilization for World War II, competition was completely eliminated. Since the war, competition has been the legally and administratively preferred method of choosing suppliers and determining prices. In practice, however, at least half of the Government's purchases of military goods and services are made without competition.

Table 1 shows the methods the Department of Defense (DOD) used to select sources of supply for its 1966 procurements. Note that the ordinary distinction between competitive-noncompetitive purchases has

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*The basis of current procurement regulation is the Armed Services Procurement Act of 1947, 10 U.S.C. 137. For background on the current policy and a history of procurement regulation, see J. P. Miller, Pricing of Military Procurements, Yale University Press, New Haven, 1949.

been replaced by a number of categories. For instance, under price competition there are three categories.

1. Formal advertising is the special method used to procure standard governmental items; a contract is awarded to the company submitting the lowest price in a sealed bid in response to a public notice.

2. Negotiated price competition is less formal; there can be interaction between the buyer and potential sellers over prices or terms of the contract before it is awarded. The contractor selected and the price paid, however, is decided by price bids.

3. "Other" price competition refers to miscellaneous programs, the most important of which are the "set-asides" for small business and labor surplus areas.

All forms of price competition accounted for a little more than 44 percent of the 1966 procurements.*

Although the price competition categories are relatively unambiguous, most of the other categories are not. Design and technical rivalry, for example, is competition on the physical merits of the actual or prospective product as well as price. It is a form of product competition. This category brings the percentage of DOD procurements made with multiple source solicitation to 50 percent.

Conversely, 50 percent of the procurement dollars were spent without competition, even defining competition in the most generous way possible as the existence of at least two potential sources of supply. Sixty percent of the single-source procurement was simple purchase of an item without considering any alternative contractor; 40 percent was by "follow-on" contracts. The latter are let as part of some program to a contractor who had received an earlier contract in the program by winning either a price or a design and technical competition. So despite the initial competition in the program for the follow-on contract, only the single source was considered.

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*Note that competition in this sense refers only to the existence of at least two sellers. In economic terms the "competitiveness" of many of the oligopolistic markets in which the Government deals appears open to serious challenge. For this study, however, the DOD definitions of competition will be accepted. A more sophisticated definition of competition would result in even more noncompetitive procurements.

Table 1

DEPARTMENT OF DEFENSE, CONTRACTOR SELECTION METHODS, FISCAL YEAR 1966

Method	Amount ($ million)	Percentage
Multiple-source solicitation		
Price competition		
Formally advertised	$ 5,283.2	14.2
Negotiated	7,799.7	20.9
Other[a]	3,456.1	9.3
Total price competition	$16,539.0	44.4
Design or technical competition	2,062.2	5.6
Total multiple-source	$18,601.2	50.0
Single-source solicitation		
Follow-on[b]	$ 7,449.0	20.0
Other	11,178.4	30.0
Total single-source	$18,627.4	50.0
Total procurement[c]	$37,228.5	100.0

NOTE: Detail may not add to total due to rounding.

SOURCE: Military Prime Contract Awards and Subcontract Payments or Commitments, Office of the Assistant Secretary of Defense, Installations and Logistics, July 1965-June 1966, Department of Defense, Washington, D.C., n.d., p. 32.

[a]Small business and labor surplus set asides and open market purchases.

[b]After price or design or technical competition.

[c]Except intragovernmental.

Source selection procedures are closely related to the types of goods and services the Government procures. For items with a close civilian counterpart -- shoes, trucks, paint, and similar items -- price competition is the rule. Interfirm price rivalry determines both the contractor and the price the Government pays. For specialized military items -- planes, missiles, electronic systems, and the like -- price competition is infrequent, because of the characteristics of

research and development (R&D) and the Government's weapon system acquisition strategy.

The relationship between product and source selection can be seen by examining Table 2 which shows Air Force procurement for 1966. (A comparison of Tables 1 and 2 also shows that the difference in the items consumed by the various military services produces differences in the extent of competition for each service's procurements). Practically all R&D expenditures are made either by design and technical competition or by follow-on contracts. For major weapon system hardware (labeled "complete systems" in Table 2), 78 percent of all the money is expended for follow-ons to design and technical rivalry. In contrast, note the "all other goods and services" where price competition accounts for 53 percent of the expenditures. The point is that price competition is lacking primarily in the original R&D procurements and in follow-on contracts for both the R&D and weapon system hardware. This reflects two problems, the difficulty of R&D product specification and the "locked-in" position of the Government.

With some exceptions the U.S. Government has not used internal organizations such as arsenals or shipyards to produce aerospace systems. Instead it has relied upon private firms placed on contract.* This policy creates a major problem at the R&D stage. Government contracting procedures are designed to buy established products; the R&D task is to produce items with new -- perhaps even unknown -- characteristics. The result is that contractor selection and price determination by competition becomes infeasible simply because the product to be delivered cannot be specified sufficiently.

The "lock-in" problem is less inherent in the nature of the good or service being procured and more an outgrowth of governmental

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*See J. S. Dupré and W. E. Gustafson, "Contracting for Defense: Private Firms and the Public Interest," Political Science Quarterly, Vol. 77, June 1962, pp. 161-177; and the discussion among C. Kaysen, P. W. Cherington and J. S. Dupré in C. J. Friedrich and S. E. Harris (eds.), Public Policy, Yearbook of the Graduate School of Public Administration, Graduate School of Public Administration, Harvard University, Cambridge, 1963.

Table 2

AIR FORCE PROCUREMENT - FISCAL YEAR 1966
By Product Group and Source Selection Procedure[a]

Product Group	Advertised	Negotiated Price Competition, Original	Design & Technical Competition, Original	Follow-on to Price Competition	Follow-on To Design & Technical Competition	Single Source	Total
			Amount ($ million)				
Research & development	7.7	232.7	671.5	26.8	1184.1	470.8	2593.6
Complete weapon systems	0.6	44.5	0.7	322.7	1473.5	44.1	1886.1
Major components & accessories	80.6	157.9	13.8	42.6	666.4	239.9	1201.2
Communications & electronic equipment	75.5	121.8	8.0	28.6	138.9	193.8	566.6
Miscellaneous equipment	25.7	41.0	3.1	9.1	143.8	107.1	329.9
All other goods & services	196.4	916.8	91.8	53.3	425.2	530.2	2213.7
Total	386.5	1514.7	788.9	483.1	4032.0	1585.9	8791.1
			Percentage				
Research & development	0.3	9.0	25.9	1.0	45.7	18.1	100.0
Complete weapon systems	(b)	2.4	(b)	17.1	78.1	2.3	100.0
Major components & accessories	6.7	13.1	1.2	3.5	55.5	20.0	100.0
Communications & electronic equipment	13.3	21.5	1.4	5.1	24.5	34.2	100.0
Miscellaneous equipment	7.8	12.4	0.9	2.8	43.6	32.5	100.0
All other goods & services	8.9	41.4	4.1	2.4	19.2	24.0	100.0
Total	4.4	17.2	9.0	5.5	45.9	18.0	100.0

[a] Procurement actions of $10,000 or more for work in the U.S. by business firms. Detail may not add to total due to rounding.

[b] Less than 0.05.

SOURCE: DD-350: Individual Procurement Action Report

organization. The Government has almost always relied upon the same firm to develop and produce its aeronautical weapons.* This firm is given overall responsibility for all major stages of an entire program -- research, development, initial production, production for reprocurements, production of spare parts and so on. Using the same prime contractor for all these major stages has advantages for the Government. For one thing any economies of learning, of scale, or of vertical integration are maximized. For another, no time is lost or administrative expenses incurred in transferring a program from one firm to another. If there is no program transfer, the technology a contractor acquires at one stage does not have to be passed on to the contractor for the next stage. Were such a transfer to take place, it would require close administrative coordination to insure technical and managerial coordination of the various stages. The Government has not been anxious to assume technology transfer or coordination responsibility,** preferring to keep this an intrafirm matter by using the prime contractor from the start of research through hardware production.

The difficulty with this procedure is that, with some recent exceptions, contracts have not been written for the entire length of a program; instead, at least one contract is usually let for each major stage of a program.*** The reason for this is the many sources of

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*In some programs there has been both a prime contractor and associate prime contractor(s). The group of firms, however, has responsibilities at each stage of the program.

**Again, note the contrast between aerospace and other weapons such as naval systems. In the latter area the Government often has assumed close responsibility for program control. In many cases the development has been performed by a Government organization and the military service has had the responsibility for effecting a transfer of technology between program stages, for example, from the development organization to the private manufacturer.

***The recent exceptions to the procedure, applications of the total program package concept (TPPC), are discussed in G. R. Hall and R. E. Johnson, Aircraft Co-Production and Procurement Strategy, The RAND Corporation, R-450-PR, May 1967, pp. 173-179. Alternative procurement strategies and the "lock-in" problem are also discussed. Of course, to the extent that TPPC can be applied successfully, the follow-on problem will be lessened. The necessity of reducing the uncertainties in weapon system production and development makes it difficult to forecast how many weapon systems may eventually be procured with TPPC.

uncertainty involved in developing and producing a weapon system. Usually a program is well along before the weapon's performance and cost can be estimated with assurance. The number of items bought usually depends upon a host of uncertain considerations. So the Government has been unwilling to make the long-term commitments or pay the risk premium that the contractor would charge were he required to commit himself for the decade or so involved in a weapon acquisition program. Therefore, most weapon system acquisition programs have involved a number of contracts.

The lock-in problem arises when the acquisition strategy of using the same prime contractor throughout a program is combined with stage-by-stage contracting. The recipient of the first contract in a program knows that he will receive all the follow-ons. In granting its first contract for a system, even though that contract is let competitively, the Government creates a monopolist for all other contracts involving that system. The Government is "locked-in" to a contractor and must take the consequences of its lack of supply options. A brief comparison in Table 2 of the size of original and follow-on procurements indicates how valuable to contractors the "lock-in" position might be

The regulatory status of defense procurement depends upon the presence or absence of price rivalry between two or more firms. If such rivalry is present, then market forces are presumed competent for control. If not, the law requires that prices be based on an analysis of the contractor's expected expenses.* The costs that will enter the final price the Government pays are subject to a voluminous and complex body of regulation.** The Government takes cognizance of cost-affecting decisions such as salary schedules, employee benefits, and the like. Certain costs -- for example, interest expenses -- are "nonallowable." Allocation of joint costs and overhead is regulated. In short, the Government is deeply involved in contractor costing and cost management.

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*There are some minor exceptions to this general rule. Armed Services Procurement Regulation (hereafter cited as ASPR), 3-807, 3-808.1 (c).

**J. Cibinic, Jr., Cost Determination, Government Contracts Monograph No. 8, Government Contracts Program, The George Washington University, Washington, D.C., 1964.

Despite the extensive and intensive control over contractors, procurement regulation differs in many ways from the usual business regulation in the United States. Later sections of this study deal with the substance of regulation -- what is controlled and the regulatory principles applied. But at this point, an important organizational difference between procurement and public utility regulation must be considered. Procurement regulation is not a separate function some independent agency performs; it is complexly intertwined with the Government's purchasing function. This means, first, that procurement regulation responsibility is diffused and decentralized, and second, that it deals with transactions rather than firms.

In most U.S. regulatory situations, the regulating agency, at least in theory, is not a party to the contracts it regulates. Not so for procurement; the Government is both a buyer and a regulator of the purchase contracts.

Since the regulating and contracting functions are combined, there is no single authority, such as a state public utility commission or a Federal agency, that has primary regulatory responsibility. Procurement responsibility is diffused among the various military agencies that purchase goods and services. The National Aeronautics and Space Administration and the Atomic Energy Commission deal with many of the same firms that sell to the Department of Defense and they also have regulatory responsibility. The former models its procurement practices after those of the Department of Defense. AEC practices differ somewhat. Coordination within the DOD is attempted by requiring each agency to use a common set of regulations, the Armed Services Procurement Regulation (ASPR). Changes in procurement regulation occur most often because of a change in the ASPR and not, as in many regulatory situations, because of new commissions or agency decisions. Changes in the ASPR are made by DOD committee through a formal procedure for considering proposal changes submitted to it, soliciting opinions from the services, industry, and other interested parties, and finally accepting, modifying, or rejecting the proposed change.

The second aspect of combining regulation with purchasing is closely related to the first. Procurement regulation deals with individual

contracts or transactions rather than the firm as a whole. Each defense contract stands on its own feet for regulatory purposes. Legally, profits or losses on one contract cannot be offset against another contract. Each contract is supposed to have a "fair" price, with no governmental responsibility assumed for the revenues and profits of the firm as a whole. Unlike procurement, most regulatory systems attempt to control the firm as a unit. In part, regulation of contracts rather than firms occurs because many defense contractors also engage in nondefense business. In part, this policy is a historical legacy from centuries of purchasing military supplies, such as shoes, horses, canvas, etc., where the government dealt in the same markets as civilian consumers, with business competition having the main regulatory role.

Two organizations, the General Accounting Office (GAO) and the Renegotiation Board, do attempt to go beyond individual contracts. Neither, however, is similar to public utility commissions in scope or function.

The GAO was created in 1921 as part of the Federal budget reforms of the Taft administration. It is independent of the Executive branch, directly responsible to Congress, and headed by the Comptroller General whom the President appoints with the advice and consent of the Congress for a term of fifteen years. The GAO's basic functions are to develop accounting methods, sign warrants, audit the accounts of the Executive agencies, and advise Congress on financial matters.* Its audit function goes beyond assuring responsible financial stewardship; it is also concerned with determining whether agencies carry out the will of Congress.

In the defense industries, the GAO occupies a unique role. It is the definitive authority about the allowability and allocability of costs for determining contract prices. It creates and interprets regulations, as well as comments on proposed changes to the ASPR and Defense Department directives.

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*C. P. Cotter, Government and Private Enterprise, Holt, Rinehart and Winston, New York, 1960, pp. 449-450; M. J. Peck and F. M. Scherer, The Weapons Acquisition Process: An Economic Analysis, Graduate School of Business Administration, Harvard University, Boston, 1962, pp. 210-211.

In addition to these functions, that might be regarded as executive in nature, the GAO has legislative and judicial functions. As an arm of Congress, it recommends legislation, prepares reports for committees, and often has a key role in Congressional hearings on procurement matters. The GAO's judicial role is unusual. The Comptroller General issues findings in disputes between the industry and the military services over procurement matters. These rulings are presented in a form similar to judicial decisions, and, in fact, are treated by both the armed services and defense contractors as though they were court judgments.*

Despite the GAO's influential role in procurement, it is not really comparable to a public utility commission. Its attention is primarily on whether individual procurement contracts are lawful and reasonable, but it takes no responsibility for determining the appropriate profit for defense firms as a whole.

At first glance the Renegotiation Board appears similar to a public utility commission since it is concerned with total firm profits rather than individual contracts. Also, it is not a party to the contracts it regulates. During World War II when renegotiation was part of the general price-wage-profit controls the Board may have operated like a public utility commission. The wartime demand for military goods exceeded industrial capacity, so potential prices were high and large profits were possible. With the war's end, however, these conditions changed as did the justification advanced by supporters of defense profits renegotiation.**

Since World War II, overall capacity in the defense industries has been adequate to meet demands, or at least capacity has been able to be expanded when needed. For any particular program there might be a number of potential suppliers, so the demand curve for each firm was

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*Disputes between the military and contractors over proprietary data rights, for example, are almost always resolved by taking the case to the GAO.

**J. F. Weston (ed.), Procurement and Profit Renegotiation, Wadsworth Publishing Company, Inc., San Francisco, 1960, p. 51 et passim; see also F. T. Moore, Military Procurement and Contracting: An Economic Analysis, The RAND Corporation, RM-2948-PR, June 1962, pp. 118-133.

reasonably elastic viewing programs as a whole. Renegotiation was maintained, however, on the basis that a contract that was "fair" in the light of conditions at the time it was let might not be "fair" viewed after its completion. During the life of a contract, it was argued, plant production volume might change and "excessive" profits result. The present rationale for renegotiation is that it permits regulation-by-contract to retrospectively reflect occurrences unforeseen at the time the contract was negotiated. Thus, renegotiation does not provide an alternative to regulation by contract. Rather than acting like a public utility commission, the Renegotiation Board is primarily engaged in backstopping regulation-by-contract through providing an opportunity for a retrospective view of the costs upon which prices were based.

The Renegotiation Board examines as a group all the governmental contracts held by large defense contractors. However, a number of different types of contracts are exempt from this review either by statutory authority or administrative action. These exemptions seriously limit the scope of the Board's cognizance, but nonetheless, the Board does have advantages not possessed by contracting officers. The Board does not have to price contracts one by one. Moreover, while the contracting officer must price prospectively, the Board has the benefit of hindsight. In particular, the Board is in a position to assess the impact on overheads of plant-loading that occurred as a result of all government contracts the firm held during some period.

The Board, however, does not attempt to determine some appropriate rate of return on capital. The Board states: "It is apparent from the statutory language 103(e) of the Renegotiation Act of 1951 that no formulae of pre-established rates can be used to determine whether profits are, or are not, excessive in any given case. The determination in each instance reflects the judgment of the Board on the application of each of the statutory factors enumerated above to the facts of the specific case."* The statutory factors referred to are: (1) reasonableness of costs and profits, (2) net worth, particularly the amount of

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*Renegotiation Board, Ninth Annual Report, 1964, Government Printing Office, Washington, D.C., 1964, p. 3.

government furnished plant and equipment, (3) risk assumed, (4) nature and extent of contribution to the defense effort, (5) character of the business, (6) and other factors the Board may adopt. Clearly this is not a restricted charter! The Board's actual decision criteria have never been obvious to outsiders. It is clear, though, that like contracting officers the Board is primarily concerned with the "fairness" of fees as a percentage of total cost, not of capital.

In sum, as in the public utility sector, direct Government regulation of procurement prices and profits is needed because competition is lacking. This lack has a different origin in each sector. In the public utility field "natural monopoly" stems from the technology required to produce or distribute the service efficiently; in procurement, "monopoly" stems from the indefiniteness of the initial R&D products and the Government's strategy of using the same prime contractor for an entire weapon system program. The organization of regulation also differs in each sector. Unlike Commission control of utility firms, procurement regulation is combined with the Government's purchasing function. Procurement is regulated on a contract-by-contract basis rather than on a firm basis.

III. PRICE AND PROFIT DETERMINATION

Price competition results in long-run price and profit approaching levels just adequate to pay all factors of production the best prices they could earn in the best alternative occupations. A monopoly position permits entrepreneurs to charge higher than competitive prices and earn greater than competitive profits. When regulation is imposed on the latter situation, the usual response has been to try to simulate competitive results by basing prices and profits on costs. It is the cost-based nature of prices and profits that produces the similarities between the regulatory problems in defense procurement and the more traditional areas of regulation. The way each sector builds up prices from costs is different, however, and this difference is a matter of considerable importance. To illustrate, Eq. (1) breaks down into constituent parts the price of a procurement contract negotiated without price competition.*

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*Equation (1) assumes a fixed-price-incentive contract let by negotiation. For a firm-fixed-price contract, α would equal 1. If the contract were let by competition, the first term would be replaced by the target price in the accepted bid. P_a may be constrained by "ceilings" or "floors" specified in the contract, but these need not be considered here. For a full discussion of incentive pricing arrangements, see Office of the Assistant Secretary of Defense (Installations and Logistics), Incentive Contracting Guide, Department of Defense, Washington, D.C., 1965.

Pricing arrangements other than firm-fixed-price contracts are unusual outside of the procurement area. In the R&D and weapon system area firm-fixed-price contracts are rare. Cost-plus-fixed-fee and cost-plus-incentive-fee are usual for R&D and fixed-price incentive contracts are used for hardware.

A choice between two competitors on the basis of their price can only be unambiguously made with a firm-fixed-price contract. A fixed-price-incentive contract requires the Government to forecast the cost outcomes to determine the lowest bidder. A cost reimbursement contract, of course, cannot be let competitively since the Government has a liability to pay all actual costs.

For present purposes the significant difference between fixed-price and cost-reimbursement contracts negotiated without price competition is that the latter require only that the contractor expend his best efforts as long as the Government funds the contract. With a fixed-price contract the contractor has an obligation to complete a

Equation (2) does the same for the price of a utility service.

(1) $$P_a = C_t(1 + \Pi_a) + (1 - \alpha)(C_a - C_t)$$

(2) $$P_b = C_r + C_g + C_d + \Pi_b I$$

where

P_a = procurement price to the Government
P_b = public utility service price to the consumer
C_t = target cost
C_a = actual cost
C_r = cost of direct inputs
C_g = taxes
C_d = depreciation
I = investment
Π_a = profit rate (in percentage) on sales
Π_b = profit rate (in percentage) on capital
α = the sharing rate (in percentage), dividing overruns and underruns between the Government and the contractor

Any cost included in the target cost of a procurement contract (C_t) must be allowable and allocable. That is, it must be an expense that procurement law states can be reimbursed, and it must be traceable to the particular contract. Nonallocable costs are assigned to overhead accounts, and an allowance is made in the target cost to cover such indirect expenses. The operation of these general rules requires a voluminous set of regulations, but for our purposes it is fair to say that target costs consist of all legal and traceable costs identifiable with a project, plus an allowance for overhead. Defined in this way,

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project even if his costs exceed the amount of obligated public funds.

The important consideration, however, is not the pricing arrangement but whether the contract price is binding and whether it is determined by interfirm price rivalry.

*P. J. Garfield and W. J. Lovejoy, Public Utility Economics, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1964, pp. 44-45.

C_t is roughly equivalent to $C_n + C_g + C_d$. For present purposes this total will be referred to as operating costs.

The basic difference between the two regulatory systems then is that public utility profit is based on a single input, capital; procurement profit is based on the total cost of all inputs. Put differently, procurement profits are based on "full costs" rather than on investment.* The two systems are alike in that both determine prices by adding a profit component to cost. This procedure can be examined from two aspects -- one from the viewpoint of socially efficient prices, the other from the viewpoint of managerial incentives.

From the broader social point of view, regulation on the basis of cost might be optimal in a static environment. Of course, most actual regulatory authorities use cost concepts, allocate costs, permit exceptions and in other ways price differently from the way advocated by economists. For example, most regulators attempt to price on the basis of average cost rather than follow the consensus of economists that marginal cost is the relevant criterion. Actual regulatory pricing rules are not those contained in texts on efficient production and prices. Nonetheless, it is possible to conceive a set of rules that would be: (1) administrable, (2) cost-based, and (3) socially optimal in a static short run sense.

The difficulties arise with the third factor. Theoretic pricing rules say nothing about how one adjusts to or promotes dynamic events affecting demand or technology. As Kahn has expressed the matter:

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*In terms of theoretical models, procurement is a government-enforced "full-cost" pricing system such as that observed among monopolistically competitive or oligopolist firms that price on a "mark-up" system. See R. L. Hall and C. J. Hitch, "Price Theory and Business Behavior," Oxford Economic Papers, No. 2, May 1939, pp. 12-45; P. M. Sweezy, "Demand Under Conditions of Oligopoly," The Journal of Political Economy, Vol. 47, August 1939, pp. 568-573; G. J. Stigler, "The Kinky Oligopoly Demand Curve and Rigid Prices," The Journal of Political Economy, Vol. 55, 1947, pp. 432-449. The latter two articles are reprinted in G. J. Stigler and K. E. Boulding (eds.), Readings in Price Theory, Richard D. Irwin, Inc., Homewood, Illinois, 1952, pp. 410-439.

> They [economic pricing rules] and the Pareto-model from which they are derived, take incentives for granted; they do not examine the institutional problems of how best to provide them. The rules are entirely static. Information, technology, costs, product or service dimensions, demands are all taken to be known and given. All they tell us is that price for whatever services <u>are</u> offered, in whatever markets there <u>are</u> for them, which markets are presumed to be <u>known</u>, should be set at incremental costs, which too are presumed to be known, at whatever level they happen to <u>be</u>. This is not in any way to deprecate the importance of the static economic efficiency they seek to achieve. But it is to point out that the rules do not tell us <u>how</u>, by what instruments, to enact them; or how to induce superior dynamic performance -- risk-taking, cost-reduction, service-innovation, the seeking out of new markets, and so on.*

In short, cost pricing may eliminate monopoly profits, but has no inherent mechanism for assuring the appropriate costs in a world of cost-affecting change.

A subject of much recent interest to economists has been the managerial incentives that systems of regulated prices create.** Studies have shown how in several industries regulated prices have led to socially perverse motivations and thereby to distortions in resource allocation. This situation has also occurred in the procurement area. Interestingly, however, the motivations differ from those in the public utility area. The next section examines some similarities and differences.

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*A. E. Kahn, "Inducements to Superior Performance: Prices," unpublished paper.

**For a review of the literature on this subject, see W. G. Shephard, "Utility Growth and Profits Under Regulation" in W. G. Shephard and T. G. Gies (eds.), <u>Utility Regulation: New Directions in Theory and Policy</u>, Random House, New York, 1966, pp. 3-57.

IV. COST CONTROL

Pricing on the basis of costs (either actual or expected) means that the regulator must try to control costs. If cost-plus pricing is mechanically applied, there is no penalty to a firm with costs greater than required to efficiently produce some specified amount of output with the optimal production function. Conventional public utility regulation in the United States divides expenditures into operating costs and capital costs, with only the latter eligible to earn a positive rate of profit. Consequently, discussion of cost control also has generally been divided between control of operating costs and control of investment decisions. This division will be followed here.

In most regulated industries there is a danger of "nonpecuniary maximization."* If regulators permit firms to pass on operating expenses to the public and if the demand function is inelastic, then it is likely that firms will incur costs that neither earn profit for the firm, nor benefit the public, but which provide satisfaction to the management. Examples are plush offices and country club memberships. Distinguishing legitimate business expenses from "nonpecuniary maximization" is such a horrendous problem that few commissions seriously try. So there is no obvious constraint on entrepreneurial decisions that increase operating costs.

Operating cost control is an even more severe problem in the defense industries than in other regulated sectors since costs are not divided for fee determination purposes. Rather than there merely being no penalty against increasing operating costs, there is a clear incentive to maximize operating expenses inherent in the total cost-profit base. Equation (1) showed that $\Pi_a C_t$, the contractor's fee, is a function of costs, so the higher the target cost the greater the firm's profit. Procurement policy has attempted to counter this effect by: (1) using

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*O. E. Williamson, "Managerial Discretion and Business Behavior," American Economic Review, Vol. 53, December 1963, pp. 30-43. Williamson has extended his general analysis to the defense industries in, Defense Contracts: An Analysis of Adaptive Response, The RAND Corporation, RM-4363-PR, June 1965.

incentive fees, (2) adjusting profit rates, and (3) obtaining independent cost estimates. None of these, however, solves the problem.

The weakness of incentive pricing arrangements can be seen by examining the last term in Eq. (1) which causes the contractor's profit to be adjusted upward or downward as the final cost is smaller or larger than the target cost. This type of fee provides the contractor with an incentive to maximize underruns. He has, however, no such incentive with respect to target cost. The larger the target cost, the higher $\Pi_a C_t$. Also, the larger the target cost, the more likely it will be he can practice economies that will lead to an underrun, thereby increasing the fee. Given a target cost and an incentive fee, the sharing arrangement provides a contractor with motivation to try to economize on the costs of fulfilling the contract. But incentive fees give the contractor no incentive to try to produce the item in the most efficient way possible. In fact, there is a disincentive to undertake such a search. If successful, it would result in a lower target and therefore a smaller fee.

A price-competitive source selection, however, provides motivation to minimize both target and actual costs.* The lower the target costs the better are the chances of getting the contract. The

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*The relationship between pricing arrangements and methods of source selection may be made clearer by a homey example. A cost-reimbursable defense contract is similar to the arrangement between a homeowner and contractor, where the former tells the latter to fix up a house until the owner tells him to stop. The owner will probably be more satisfied if he tells the contractor that he wants the roof repaired, two coats of paint on the walls, and otherwise specifies the job and asks the contractor in advance what the bill will be. This arrangement is similar to a defense fixed-price contract let without price competition. The contractor has pressure to minimize his price only if he knows that the homeowner is soliciting bids from other contractors and is prepared to select on the basis of the price quotations. Fixed-price contracts, as this example shows, have advantages over cost-reimbursable contracts. Nonetheless, the incentive to minimize target costs comes not from pricing arrangement but from the nature of the source selection.

lower the actual costs, the higher the final rate of profit.*

Procurement policymakers have also attempted to offset the cost disincentive effects of the current system by varying the profit rate. Profit rates are supposed to reflect differences in the capital furnished by the contractor, his subcontracting, the risk assumed, and his past performance. Yet, the regulations provide no easy way to relate adjustments in the profit rate to the cost of the required adjustment in the contractor's procedures. For example, while profit rates are adjusted to account for the substitution of contractor investment for government-furnished plant and equipment, there is no way of knowing how the profit rate adjustment relates to the contractor's cost of capital. Another example is subcontracting; there is no obvious way to relate the profit rate adjustment to the relative costs of in-house production as opposed to those incurred in purchasing from a subcontractor.

Another problem is more fundamental. After the profit rate is adjusted, it is applied against the target cost to determine the profit fee. This procedure removes the efficiency incentive.

The final way that the current procurement system attempts to protect the public interest in obtaining efficient target prices is through independent target-cost estimates by the Government. The

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*While it is hard to see how incentive pricing arrangements can affect target costs in the short run, it might be argued that in the long run there could be a relationship. If actual cost outcomes were the basis for future targets, the contractor's desires for short-run profit maximization would lead, in the long run, to lower targets. This process could work if each firm had only one contract at any point in time and each contract were for the same product In such a case, the contractor's optimal strategy would be to attempt to increase his labor force and other cost items as much as possible just before he negotiated a contract. Immediately after he signed the contract he would then cut costs to the minimum. Of course, the Government would observe this process, and the contractor would face a delicate problem in game theory.

Contractors usually hold a number of contracts at any one time for a variety of products. Movement of personnel and other cost items among projects and cost allocation is so complex that it is unlikely that any outsider could ever determine whether an underrun was due to contractor efficiency or to overstated budgets. Consequently, it is doubtful whether even long run incentive arrangements could affect target costs.

difficulties with this thrust will be obvious to anyone familiar with the dreary history of attempts to determine public utility rate bases.

One difficulty is that the information base available to the Government consists of contractor-furnished records, so there is good reason to worry about the parity of bargaining strength. Even if the Government had full access to all relevant data, it is questionable that the appropriate prices could be estimated accurately enough to regard cost analysis as an assurance of reasonable target costs. Cost allocation is always a difficulty.* Since the products are frequently the result of new inventions or innovations, cost estimation uncertainties are substantial. Even more serious, cost estimation cannot take into account the incentive function of prices. With prices determined by supply and demand, the entrepreneur has an incentive to seek cost-reducing innovations. With cost-based prices, this effect is removed and cost analysis cannot build the incentive back into the cost calculations. Finally, cost estimation and analysis cannot take into account interfirm differences in price policy and efficiency that frequently lead to a substantial spread between cost quotations in competitive situations. Cost analysis techniques are designed to estimate some "normal" or "average" price. In fact, among defense contractors in competitive situations, differences between the average of the bids and the minimum bid frequently run from 20 to over 100

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*Cost estimation and allocation is even more difficult for defense than it is for other industries. Not only are the usual statistical problems present, but the lack of a common accounting system among defense firms greatly lessens the reliability of cost estimates. A typical example was cited by Vice Admiral H. G. Rickover: "I had one case where Navy and General Accounting Office auditors conducted several expensive audits to determine one supplier's actual cost in making equipment for the Government. These audits and evaluations lasted nearly a year. Altogether there were seven reports containing 11 differing estimates or evaluations of the supplier's costs in addition to the estimates made by the supplier himself. These reports showed estimates of costs differing by as much as 50 percent for the same item." U. S. Congress, House of Representatives, Committee on Appropriations, Subcommittee on Department of Defense Appropriations, Hearings, Department of Defense Appropriations for 1967, part 6, 89th Cong., 2nd Sess., Government Printing Office, Washington, D.C., 1966, p. 168.

percent.* These differences are probably due to differences in pricing objectives and firm efficiencies. With such great variations among supply prices, it is hard to see how cost analysis can estimate minimum supply prices.

In short, how to control operating costs in procurement remains an unanswered question. Nonetheless, procurement policymakers have devoted substantial effort to trying to devise methods to control operating costs. Their concern stands in contrast to the public utility regulators. Despite the concern of academic economists about the possibilities of inflated public utility operating costs, regulatory commissions have not given major attention to this problem for two reasons. The first is that in the operating cost area there is merely a lack of incentives to minimize costs; in the asset area there is a positive incentive to increase costs. Consequently, most public utility commissions have tried to control the rate base rather than the operating costs. The second reason for the relative lack of attention is that control of operating costs requires the regulator to validate a host of daily managerial decisions. Commissions have preferred to try to control the fewer and more easily understood investment decisions.

Public utility commissions claim to take managerial operating cost efficiency into consideration in judgments about rates. In most regulatory situations, the profit rate is not a point variable but some "zone of reasonable rates," for example, 6 to 8 percent. That is, if the firm's actual earnings fall in this range, the utility commission will regard the profits as reasonable.** If a commission views a utility as particularly efficient, it will frequently permit actual earnings to hover around the upper limit. Conversely, if the commission views the firm as inefficient, it will often permit profit

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*G. R. Hall and R. E. Jonnson, Public Policy Toward Subcontracting, The RAND Corporation, RM-4570-PR (DDC No. AD 615656), May 1965; S. S. Handel and R. M. Paulson, A Study of Formally Advertised Procurement, The RAND Corporation, RM-4984-PR (DDC No. AD 637461), June 1966.

**C. F. Phillips, Jr., The Economics of Regulation, Richard D. Irwin, Inc., Homewood, Illinois, 1965, pp. 288-291.

rates to remain near the lower limit. This range, therefore, provides an incentive for managerial efficiency.*

These efficiency incentives that public utility commissions assertedly provide are much more indirect and subjective than those the procurement area provides. Also, despite the "zone of reasonableness" concept, there are good and sufficient reasons for questioning the success of public utility regulations in creating managerial motivations for operating cost control. As Bonbright, perhaps the economist most knowledgeable about public utility regulation, sympathetically put it, "...the incentive-enccuragement features of orthodox rate regulations are extremely crude and one may suspect that they are very ineffective in comparison with the stimulation of direct and active competition."**

In short, any attempt to control operating costs of regulated firms encounters two difficulties. One is that even if, as in the public utility area, no profit is paid on operating costs, expenditures may have value to managers and there is no mechanism to prevent them from increasing costs in order to achieve "nonpecuniary maximization" of utility. The second general difficulty is that despite attempts by regulators to build incentives into the system, cost control can only be directed toward the static goal. The incentives inherent in competitive markets to promote or adjust to change are absent.

The procurement area faces an additional problem. Since costs are not divided for fee purposes, an increase in target costs can lead to a higher fee. As a result, the profit maximization incentive works

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*Two other incentives should be noted. One is that firms are not given a guarantee that they will achieve the commission-set "fair rate of return." The other is the "regulatory lag." There is usually a long delay between commission notice of return greater than the "fair rate of return" and administrative action to change rates. Superior managerial efficiency may be reflected, therefore, in extra profits due to inefficient regulation.

**J. C. Bonbright, Principles of Public Utility Rates, Columbia University Press, New York, 1961, p. 54. For a less restrained criticism, see B. W. Lewis, "Emphasis and Misemphasis in Regulatory Policy in W. G. Shepherd and T. G. Gies (eds.), Utility Regulation: New Directions in the Theory and Policy, Random House, New York, 1966, p. 232-233.

against achieving cost efficiency. Current policy attempts to counteract this perverse incentive all have limitations. Procurement regulators, however, have properly been more concerned with the problem of operating cost control than more traditional regulatory authorities have been.

Turning to the problem of controlling investment, there are two different effects that have been receiving attention from theorists.* One is that as long as the permissible rate of return on assets allowed a regulated firm exceeds the corporate costs of capital, the firm has an incentive to invest. The second is that if capital expenditures can earn a higher profit rate than operating expenditures, there is an incentive to substitute the former for the latter where technically feasible. Both incentives result in overinvestment. Three different ways overinvestment can occur have been discussed in the literature: (1) the provision of more capacity than needed to efficiently produce the scheduled output; (2) the use of more capital-intensive production methods than optimal; and (3) the addition of assets to the rate base by diversifying into other industries. While the first two procedures have considerable relevance for procurement regulation, the third procedure has not been of great importance for the producers of major weapon systems; most have relatively little nonmilitary business.

The possibility that defense contractors may acquire more facilities than required has been suggested by several commentators and particularly emphasized by Williamson.** The notion is this: If an unnecessary current expenditure is reimbursed, it may be valuable to a firm even if it earns no fee. This is because the expenditures may increase the firm's capability or capacity and therefore increase its reputation and probability of obtaining and fulfilling future contracts. In other words, the current expense may really be an investment for the future.

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*H. Averch and L. L. Johnson, "Behavior of the Firm Under Regulatory Constraint," American Economic Review, Vol. 52, December 1962, pp. 1052-1069; S. H. Wellisz, "Regulation of Natural Gas Pipeline Companies: An Economic Analysis," Journal of Political Economy, Vol. 71, February 1963, pp. 30-43; W. G. Shephard, "Regulatory Constraints and Public Utility Investment," Land Economics, Vol. 42, August 1966, pp. 348-354.

**Williamson, Defense Contracts, pp. 6-11.

A plausible scenario can easily be developed. A firm receives a contract for an important, uncertain, and generously funded project. It sees the project as a chance to establish a reputation in a new area or build up a specialized labor force. Consequently, it "loads" the target cost, perhaps even accepting a somewhat lower profit rate or somewhat stiffer sharing rate than it might have been able to obtain with a more austere project. Everyone is happy. The Government contracting officer can show that he obtained a low profit rate or advantageous sharing formula; the firm has gained what are in effect future-valuable facilities at no cost to it.

It is difficult to test such a hypothesis empirically.* But the possibility of such a process at work -- perhaps subconsciously -- is great enough to cause worry about the social desirability of the current size and organization of the defense industries. In particular, one wonders how cost-based pricing for follow-on contracts influences the size of R&D efforts. It could be that there is a "product competition" based on an organization's size, skills, and facilities. The size, skills, and facilities can be financed by the current full-cost pricing system. Lacking relevant data, such hypotheses are speculative at this point.

That more capital intensive methods of production -- or at least more overhead cost using methods of production -- than are desirable have been introduced into the defense industries is a possibility that also has worried policymakers. There has been concern about the growth of overhead expenses in defense production, particularly in the aerospace industry. DOD committees have been set up to study this problem, and various overhead control proposals are under discussion.**

One proposal for controlling overhead costs has particular interest here because it would shift from the conventional procedure of treating

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*Some evidence on a related point, the retention of employees by aerospace contractors in the face of sales declines, is analyzed in F. R. Arditti and M. J. Peck, Defense Contractors and Labor Adjustment, The RAND Corporation, P-3438, September 1966.

**Air Force Systems Command, A Program for the Overhead Cost Management Project, Appendix D to AFSC Operations Order 66-5, August 1966.

all procurement costs alike. Instead costs would be divided somewhat like public utility regulation. Costs of large weapon-system prime contractors would be separated into direct operating costs and overhead. The former costs would be covered by the usual type of procurement contracts; the latter by separate fixed-price contracts.* Since the entrepreneur would keep all the differences between the actual and target fixed-price contract for overhead he would have a strong incentive to economize on these expenses. Direct costs would be covered by the usual types of contracts, most likely fixed-price-incentive or cost-plus-incentive-fee contracts, with the contractor retaining only some portion of the underruns and bearing only some portion of the overruns. This plan, it is hoped, would encourage tighter governmental and contractor control over costs.**

The system resembles public utility pricing in that costs are divided and have different profit rates. In the public utility sector, operating costs earn a profit rate of zero while investment costs earn a positive rate of return. In the plan being considered here, direct cost contracts would presumably carry a higher target profit rate than overhead cost contracts; however, the respective sharing rates would have to be evaluated before the effective profit rates could be determined. Such a system, nonetheless, would open up the possibility of managerial decisions designed to substitute one form of cost for another. This phenomenon would be analogous to overinvestment in

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*The British are instituting such a system. Second Report of the Inquiry Into the Pricing of Ministry of Aviation Contracts, H. M. Stationary Office, London, February, 1965.

**A virtue supporters of this proposal emphasize is that it would avoid the allocation of overhead expenses to contracts as is now required because we price on a contract-by-contract basis. This advantage is somewhat lessened by the fact that this system would require an allocation of overhead between governmental and commercial business for any contractor doing both types of work.

In defense procurement usage, the distinction between direct and overhead is one of allocability. Overhead costs are expenses that cannot be attributed to a particular contract or contracts. They are classified in "pools" and allocated among contracts on some basis, such as direct expenses or labor hours.

public utilities as a result of using capital incentive, though less efficient, methods of production.

One can easily design a system that provides an incentive for contractors to minimize one type of cost. The problem is that this minimization may increase the total production cost. Contracting separately for overhead costs would provide strong incentives to keep this type of cost low. It might, however, lead to more expensive weapon systems.*

A hypothetical example can illustrate how this might occur. Assume a firm operating under the proposed system had, in addition to the fixed-price overhead contract, five contracts covering direct costs. The firm could close down its computer division and contract an independent data processing firm to handle its computations. Each data processing job would go to the independent data processor with one of the five production cost contract numbers. The bill for each job would be charged to the applicable contract, excluding the few administrative tasks (such as preparing payrolls) which would be charged to the overhead contract. For cost reimbursement contracts, the total charge -- including the data processing firm's overhead -- would be recovered, plus some profit (excluding overruns on cost-plus-incentive-fee contracts); for fixed-price contracts, the amount recovered would depend upon the

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*This statement does not imply support for the "balloon" theory of cost control. Observers of current efforts to control costs in military procurement sometimes compare the problem to a balloon. That is, when one part is squeezed, the only result is that another part expands. The implication is that governmental efforts to lower costs for one part of a system cause contractors to make up the difference by increasing some other cost element. The obvious question is, "If contractors can increase some specific cost element after another element is lowered, why did they not increase the first element before?" Put another way, profit maximization implies that contractors will attempt to increase each element of target costs whenever they can, regardless of what controls are placed on specific cost elements. In short, the "balloon" theory appears inconsistent with the usual assumptions about contractor goals. The proposition advanced in this study is different from the "balloon" theory. It is, that control of one cost element will lead entrepreneurs to take decisions that minimize the controlled element of cost, and that such decisions often will increase the total system cost.

original allowance made for computer costs. Even if operating its own computer division would be more efficient than utilizing outside firms, the contractor would have an incentive to shift the cost from indirect to direct through his production decisions.*

Only by making an independent cost evaluation could the Government discover whether the decision to abandon the computer division was motivated by a desire to lessen total costs, or by a desire merely to increase profits by lessening the ratio of indirect to direct costs because of a favorable profit rate differential. This independent evaluation would not only require many manhours but the result would be largely a matter of judgment.

The computer example is merely a case of a general problem of public utility regulation where costs are separated into classes, and different profit rates are allowed for each category. To the extent that the firm can affect the distribution of costs among classes by its decisions about production and investment, it will choose the distribution giving it the largest profit, and not necessarily the one with the lowest social costs.

In the public utility area, this problem arises when entrepreneurs desire to substitute capital for operating charges with the result that the total cost of the output selected will be larger than the most efficient cost. A statistical analysis of telephone and telegraph regulation has yielded some quantitative estimates of this phenomenon for one industry.** Certainly, the problem is encountered in a wide variety of situations and had plagued public utility regulators long

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*To generalize, the ratio of direct to indirect costs depends upon the degree of a firm's vertical integration. This is because goods and services purchased from other firms are a direct cost. Of course, the price paid for these goods will, in competitive equilibrium, cover the producer's indirect costs. This means that comparisons of the ratios of direct to indirect costs for various firms are meaningful only if all firms are vertically integrated over precisely the same functions (excluding the unlikely case where all functions require exactly the same proportion of indirect costs).

**Averch and Johnson, pp. 1052-1069.

before economists attempted to express it in formal models that could be statistically tested.

With separate contracting for overhead, the cost shifting might be somewhat different than in the public utility sector. Given an entrepreneurial choice between two production methods -- one based on costs that would go in overhead accounts, one based on direct cost items -- the decision would depend upon the profit rates on each contract and the sharing rates for cost overruns and underruns. The point is that attempting to control costs by contracting separately for overhead could introduce an important bias into defense contract managerial decisionmaking. The plan would "load the dice" in any choice between two actions, one of which would use more capital, indirect labor, rent, taxes, or similar items than the other. This bias would affect all automation decisions, subcontracting, collective bargaining agreements, make-or-buy decisions, mergers, investments in new lines of business, and labor force assignments -- in short, almost every managerial decision one can imagine.

Analysis of separate contracting for overhead expenses has topical interest since this proposal has been under discussion recently. It has been considered here for a different reason. This proposal illustrates two points about control problems in defense contracting. The first is that any attempt to divide costs into groups for separate regulatory treatment creates the potential for cost shifting to the firm's advantage. Despite many drawbacks to the current procurement pricing system, this, at least, is one problem we do not have now.

The second point is much more important. Separate contracting for overhead might lead to tighter control of overhead accounts. Or it might lead to entreprenurial decisions to shift expenses in a way that would increase costs. In any event it would do nothing about the basic problem of controlling the total cost of defense products and not the cost of any particular segment. The important task is to offset the incentives in our weapon systems acquisition procedures that lead to higher than minimum target cost. This task requires new approaches. One possible new approach that has occasionally been suggested is application of the public utility concept of regulation

to the defense sector. This is suggested because the major defense procurement problems arise from the cost-based nature of procurement prices.* Since public utility prices are also cost-based, it seems reasonable to hope that public utility experience could yield methods of improving the performance of defense procurement. The next section considers this possibility.

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* The McClellan Committee Report of 1964 exemplifies how concern about the procurement system and also public utility regulation often coalesces. After criticizing missile procurements and discussing the need to avoid "profiteering" the Report states: "This is not the first time that our Nation has found itself in a situation to serve properly the needs of the people." The growth of public utility regulations is then discussed as an example of adapting economic institutions to public needs. U.S. Congress, Senate, Committee on Government Operations, Permanent Subcommittee on Investigations, Pyramiding of Profits and Costs in the Missile Procurement Program, Report No. 970, 88th Cong., 2nd Sess., U.S. Government Printing Office, Washington, D.C., 1964, pp. 1-3.

V. A PUBLIC UTILITY STATUS FOR WEAPON SYSTEM PRODUCTION?

Consider the Government's anomalous situation when procuring major weapon systems such as aircraft and missiles. It chooses to have these items developed and produced by private organizations rather than in its own laboratories or arsenals. Yet at the R&D stage its inability to specify the requirements for fulfilling the contract means that competition is precluded. And since the Government does not write production contracts until R&D results have clarified the product, it is again precluded from using competition because it does not want to be responsible for effecting the technology transfer from the developer to the manufacturer.* Since competition plays so little a role in setting prices, the Government assumes the burdens of protecting the public interest by seeking to assure "fairness" of procurement prices and profits.

Note the Government's dual role. On the one hand it is a buyer desirous of a good price and a responsive and cooperative supplier, particularly in the R&D phase when the interaction between the buyer's requirements and the contractor's results are particularly intense. On the other hand, it must regulate the prices and profits the contractors receive. The Government tries to achieve both goals through its contracting practices.

There is a school of thought that advocates changing this procedure. It would dispense with regulation through contracting and apply the public utility concept to weapon system production. This position rests on two beliefs: (1) that the performance of the current procurement system is unsatisfactory because contractor profits are excessive; and (2) that extending public utility regulation to large defense contractors would resolve the difficulties.

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*The usual weapon system acquisition procedure rests on two assumptions. First, initial cost and product uncertainties preclude writing contracts for an entire program. Second, there are significant economies from using the same contractor throughout an entire program. TPPC has called the first assumption into question; more attention could profitably be devoted to the second.

This view is misleading. It is based on a false concept of procurement problems. The regulatory task is not to assure that profits of large defense contractors are reasonable but to assure that the weapons we acquire are produced efficiently. For this latter task, the public utility model provides little assistance.

To illustrate the case for public utility regulation, consider the analysis by D. N. Jones, who advocates extending the public utility concept to nine major weapon system producers.* Jones holds that subjecting the large weapon system contractors to public utility regulation could achieve the performance standards identified with "workable competition." The objectives he seeks are:

> Prices that show a reasonable relation to costs; earnings which show a reasonable relation to risk; efficiency in resource allocation through, for example, avoiding the competitive excesses of hoarding technical personnel, squandering scarce creative skills, and duplicating research and design efforts; and innovational advances by removing the pressures toward preoccupation with tangible and immediate production consequences in the firm's development efforts. For labor it could mean stable employment at a long-run maximum average wage; for management more stable earnings prospects; and for the public a minimum long-range price and high quality product.**

According to Jones, a public utility status would place the regulated firms "midway between the arsenal concept with its direct governmental ownership and their present private but privileged position."*** Jones particularly stresses the need to change profit outcomes. Profits

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*D. N. Jones, "Extension of the Social Control of Utilities," Land Economics, Vol. 41, November 1965, pp. 297-302. The nine firms are: Boeing, Convair, Douglas, Lockheed, Martin, McDonnell, North American, Northrop, and Republic.

**Ibid., p. 300. Interestingly, the Government raised the question of a public utility status for weapon system producers in the Boeing case (Tax Court of the U.S., 37 T.C. 64, 1962). The Government cited Munn v. Illinois (94 US 113), a classic public utility case, in support of the view that aircraft production is legally "affected with a public interest." This argument is discussed in Moore, pp. 129-130.

***Ibid., p. 300.

should, he believes, be measured as a rate of return on investment and be regulated in accordance with public utility principles.

Jones argues at some length that defense market characteristics fit the traditional public utility model.* One's first reaction to this view is that since public utility regulation has been applied to such a heterogeneous set of market structures, it is unnecessary to debate whether the defense industries meet public utility standards.** Yet, further exploration of the problem indicates that it is important to consider the structure of the industry. The issue is not whether defense procurement somehow "fits" the public utility mode, but whether the performance we want defense contractors to achieve is consistent with the performance promoted by public utility regulation.

In general, the goods or services that public utility firms produce are reasonably well defined, and output capacity can be at least imperfectly specified. The outputs and capacities of the major weapon system producers are less clear. For instance, one can argue that their outputs are the hardware that comes off the assembly lines. Alternatively, one can argue that their output is the R&D services and the management and integrative activities that go into the assembly process as intermediate services.

If one adopts the latter position, measuring capacity is difficult since capacity is the ability to respond quickly and satisfactorily to governmental demands for new military items. Indeed, this view of the function of major defense contractors is the basis of what is probably

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*For an argument to the contrary see B. S. Beckler, "Defense v. Public Utility Pricing," Department of Defense Logistics Research Conference -- Individual Professional Papers, Vol. 2, Issue 2, May 26-28, 1965, pp. 77-82.

**Jones' analysis of the market characteristics and public policy goals are highly challengeable. On this subject, compare M. J. Peck and F. M. Scherer, pp. 17-97; F. M. Scherer, The Weapons Acquisition Process: Economic Incentives, Graduate School of Business Administration, Harvard University, Boston, 1964, pp. 1-4; H. O. Stekler, The Structure and Performance of the Aerospace Industry, University of California Press, Berkeley and Los Angeles, 1965, pp. 154-196; C. J. Hitch and R. N. McKean, The Economics of Defense in the Nuclear Age, Harvard University Press, Cambridge, Massachusetts, 1963, pp. 243-265. Lack of discussion here of Jones' position does not imply concurrence but rather a desire to concentrate on the fundamental point, the profit base.

the strongest argument for applying the public utility concept to weapon system producers. The "capability" argument asserts that our current strategic posture demands quick response abilities by defense firms to uncertain and rapidly changing military demands. Like electric utilities, the defense sector must meet "peak load demands," and this requires stand-by capacity which, the "capability theory" asserts, can best be provided in a public utility framework.*

Current procurement regulation is on a contract-by-contract basis with little direct control over the revenues and profits of firms as a whole.** The Government, nevertheless, desires that producers respond directly and effectively to new demands. Therefore, there has to be enough "slack" in the system to meet peak demands and to allow rapid shifts among programs. The Government in a sense is buying the general capabilities and capacities of firms as well as R&D and hardware. More precisely, capacity and hardware are joint products. The best way to finance such products, the argument runs, would be to treat these firms as public utilities and be prepared to subsidize current operations if necessary to maintain facilities to meet sudden demands.

Although this is probably the strongest argument for public utility status, it is still unpersuasive. The "public utility commitment" of an electric utility firm implies a responsibility of that firm to meet peak load demands for certain classes of customers. The commitment reflects the decreasing cost function for electric generation and the increasing cost of distributing electricity geographically. The analogous problem for procurement is providing sufficient industry capacity to meet peak load demands. The cost relationships are quite

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*This argument is explicitly made by J. R. Schlesinger and it is implicit in many discussions of the need to preserve a mobilization base. See "Will the Defense Burden be Lighter?," Challenge, Vol. 9, June 1961, p. 32. Ironically, even though he cites the Schlesinger article, Jones does not develop the capability theory to support his case for extending the public utility concept to weapon system production.

**As previously noted, the Renegotiation Board does consider firm profits as a whole, but its responsibility does not extend to ir uring adequate industry capacity.

different from electric services. Only if profits decline to the point where firms begin to leave the industry need the Government worry about this problem. In fact, in recent years firms seem willing to operate below full capacity and even those firms that have very low capacity utilization rates seem unwilling to leave the industry. Government ownership of much of the capital in the aerospace industry undoubtedly assists in maintaining firms even with low plant utilization levels. Thus, if the argument for a stand-by capacity has any policy implication, it would seem to point to more use of Government-furnished plants and equipment rather than to public utility status.

Even though the "capability theory" does not seem to justify public utility status for weapon system producers it points up the difference between the outputs of public utility firms and the major defense contractors. Public utilities mainly produce well understood goods and services to meet relatively well established demands. Weapon system manufacturers develop and produce new items to meet ill-defined and rapidly changing consumer demands. In both areas the regulatory goal is that vague concept, a "fair price." In the public utility area, however, the product is reasonably well understood and the major emphasis is on eliminating monopoly rents. In defense procurement we really do not know what the firm should be producing or what its output should cost. Consequently, regulation has to be less concerned with monopoly rents and more concerned with trying to define standards of reasonable costs.

The difference between the desired performance of behavior of defense contractors and public utility firms is also apparent on the input side. The input that has received the most attention in public utility regulation is capital. Public utility firms have been viewed primarily as investment organizations, and the pricing system has reflected this view. Linking profits to the firm's capital contribution provides a set of managerial incentives consistent with this view of the public utility's responsibility even though, as discussed previously, it provides little or no stimulus to seek maximum productive efficiency.

This view of the firm has much less relevance for the defense area. In the past, the Government has been an important weapons' producer

through the arsenal system. With the plants and equipment and progress payments it furnishes, it is still an important supplier of capital to the major weapon system producers. At times, perhaps half of all assets used to produce weapon systems have been government-owned. At present the Government seeks to lessen its role as an investor. Nonetheless, the use of private firms does not rest on the view that investment should be a function of private capital; it rests on the view that private firms have important advantages over Government organizations apart from the investment function.*

Moreover, the significance of the managerial incentives problem differs between the public utilities and procurement sectors. It may not be terribly important that public utility regulation has been unable to build into the pricing system a set of managerial incentives. Production processes are usually importantly based on engineering technology that the regulators understand. The regulators, therefore, may be able to assess reasonably well what the most efficient ways are to accomplish a given task. Consequently, it may make sense to concentrate prices on the area of finance and investment. This approach will not suffice for procurement since it is the uncertainty about production that has led to the use of private contractors in the first place.

Put more generally, profits play a number of roles. They provide, inter alia, an incentive for managerial efficiency, a method of attracting, rationing and rewarding investment, a means of allocating goods.

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*Jones notes that a public utility status for aerospace would require an adjustment for Government-owned plants and equipment, p. 300. He does not consider, however, the functional and ideological implications of the Government's role as investor. Beckler, p. 82, discusses the inapplicability of the return-to-investment standard, but does not specify what items should be included in the "other cost criteria" that he holds relevant. The Herbert Committee once argued "...the profits of the [airframe] industry are perhaps better expressed not in terms of (a) return on earnings; (b) return on invested capital; (c) return on net worth; (d) return on net sales, but to a large extent in terms and in the sense of a 'management fee';" U.S. Congress, House of Representatives. Committee on Armed Services, Subcommittee for Special Investigations, Report on Aircraft Production Costs and Profits, U.S. Government Printing Office, Washington, D.C., 1956, p. 3105. The Committee gave no guidance, however, about how the "fee" should be established.

and services among consumers and thereby determining the distribution of income.* In competitive markets, profits can perform all these functions simultaneously, but only because they are a residual. In regulated markets, products are not a residual but a predetermined component of the target price. Predetermined profits can easily perform the investment-attraction function of competitive profits. It is even conceivable that they could perform the resource allocation function. It is hard, however, to conceive of predetermined profits playing the role of simulating the search for efficiency.** A reward given in advance is a contradiction in terms.

Historically, public utility regulation has been reasonably successful in assuring that firms have an incentive to invest and that the rate of return on this investment is in some social sense "reasonable." Public utility regulation has had little success in assuring that firms choose the most efficient procedures. Nor has traditional regulation been successful in linking profits to the firm's relative success in seeking new and improved methods of doing business or in adapting to changes in its environment. Yet, it is precisely in the area where traditional regulation has been the weakest that the major procurement policy problems lie. The present regulatory system has two deficiencies. First, there is no assurance that target costs are set at the minimum level necessary to produce the system. Considering the perverse incentives inherent in the current profit system, it is hard to avoid suspicion about the costs of weapon systems. The second problem is perhaps even more serious. It is that the present system does not link up profits and the contractor's responsibilities even to the extent that these are linked in public utility regulatory policy.

Under the present arrangement the developer and manufacturer of a system is paid a fee determined as a percentage of the estimated target cost of the contract. Yet, surely the contractor's role in a program is not to furnish total cost. But just how is his role reflected in his

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*Bonbright, pp. 48-65.

**Ibid., pp. 53-54, 262-265; Shephard and Gies, pp. 30-31, 219-223.

fee? At one time, perhaps, one might have argued that the success of a development project could be measured by the size of follow-on manufacturing orders. Were this the case, a full-cost pricing system might provide some rough way of compensating contractors for the importance of the R&D results. Today, however, many items developed never reach quantity production because of changing strategic considerations. Consequently, full-cost pricing cannot be justified as rewarding R&D, and it is not easy to see its relationship to any other functional activity of entrepreneurship.

The problem of defense profits is not that they are too high, but that there is no obvious relationship between profits and the contractor's responsibilities. Measured relative to the activities they are supposed to induce, we do not know whether profits are too high, too low, or just right. We simply lack an adequate definition of what profits are supposed to reward. There is a vital need to move away from full-cost pricing, define the contractor's role in weapon system acquisition programs, and relate his fee to this function. The contractor's primary orientation, however, is not providing physical assets; consequently, a public utility pricing system would only further confuse the logic of procurement regulation.*

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*British procurement policy determines weapon system profits by use of a public utility type of system. Profits on individual contracts are computed by applying a profit rate to the total cost. The profit rate is supposedly determined on the basis of the contractor's contribution of capital. Specifically, the Ministry of Technology negotiates with each contractor a standard for "normal efficiency." In cases where the Government's requirements are unusual, adjustments are made. Since it is difficult to allocate capital to individual contracts, capital is related to the firm's overall business. The firm's total production cost is then computed. Taking the ratio of the cost of production to capital gives a turnover ratio. The rate of return on capital is then adjusted by the turnover ratio to obtain the rate of profit to apply to the costs of individual contracts. (Notes supplied to the author by the Ministry of Technology.)

This procedure raises two questions. Considering the accounting problems of computing the turnover ratio, does the resulting profit rate for individual contracts have a closer relationship to investment than U.S. profit rates have? The second question is, does contractor behavior differ under the two systems? Unfortunately, these issues have not been studied sufficiently to permit answers.

In sum, the case for extending the public utility concept to the development and production of major weapon systems is unpersuasive. The need for regulation arises from the lack of competition in the procurement area. This is a consequence of the nature of R&D and the weapon system acquisition strategy adopted by the Government. The goal of procurement regulation, a "fair price," is the same in both the public utility and procurement areas, but the regulatory task differs. In the public utility area elimination of monopoly profits is foremost; in the procurement area the regulatory difficulties stem less from excessive profits and more from lack of knowledge about what efficient costs might be.

A public utility type of regulation for weapon system acquisition would not alleviate this situation. The public utility pricing system is based on rewarding investment. This policy accords with the view of the public utility firm as primarily oriented toward evaluating capital needs and tapping private capital markets for funds. Rewarding investment is not the key role of procurement regulation. The Government is a major investor. More significant, it would be inappropriate to view defense contractors as primarily oriented toward investment or to encourage them to be so oriented. For one thing the differences in the products of the two sectors makes the public utility model irrelevant on weapon system acquisition. More generally, public utility regulation is fairly successful in eliminating monopoly profits and rewarding investment, but unsuccessful in motivating firms to seek the most efficient adjustments of production technique. In procurement, it is not monopoly profit or the stimulation of investment that is the important consideration. It is motivating managerial attempts to decrease the target costs of weapon systems. Little, therefore, would be gained by a change from the present system to public utility regulation.

VI. CONCLUSIONS

The major conclusions of this analysis are simple and straightforward. Perhaps the most important is that the basic problems of procurement prices and fees stem from the fact that they are cost-based and, therefore, present inherently perverse managerial incentives. These disincentives cannot be overcome by such contracting devices as incentive fees, weighted guidelines for profit rates, or better cost estimating systems. Such procedures have virtues, but they leave the cost-based nature of most procurement prices unchanged and, therefore, the basic procurement problems remain unchanged.

Since public utility prices are also cost-based, procurement and public utility regulation have many common features. Nonetheless, there is a fundamental difference in the two systems. The procurement system bases fees on total costs, while the public utility sector bases its fees on the cost of an input, capital. The perverse incentive in public utility industries is to substitute fixed costs for direct costs or otherwise overinvest. In procurement, the perverse incentive is more general. An increase in any component of target cost will, ceteris paribus, lead to an increase in profit.

Splitting costs into categories that earn different rates of profit, as in public utility regulation or as proposed by advocates of separate contracting for defense overhead costs, poses special disincentive problems. The regulated firm is motivated to shift costs among categories through its decisions about what production processes to use. Thus the firm may maximize its profits, but perhaps not use the most efficient production process. One merit of the current procurement profit system is that it treats all costs as a unit rather than splitting them and having to deal with the cost-shifting problem present in the public utility area.

The question naturally arises about the desirability of shifting from a total cost system for fees to a public utility-like system that bases fees on capital. Applying the public utility concept to procurement would have one advantage. The present total-cost system of procurement pricing makes it difficult to see how fees relate to the

contractor's function. Basing profits on an input has the advantage of providing a nexus between the firm's activities and its profits. The public utility principle of basing profits on the capital input, however, would provide little assistance in improving procurement system results. Providing productive assets is not the raison d'etre of weapon system manufacturers. The Government has previously been a major investor and even today stands ready to be an "investor of last resort." More important, the use of private firms to develop and manufacture major weapon systems is not based on a preference for private rather than public investment. It is based on a preference for private rather than public organization and management of weapon system acquisition programs. Profit policy should reflect the functional responsibilities of weapon system contractors. While the present profit policy does not link functions and fees satisfactorily, a public utility profit system would further confuse the logic of procurement profits.

This illogic might be accepted if applying the public utility model to defense procurement would assist in cost control. This is unlikely, however. Public utility regulation has not been very successful in guaranteeing that the operating costs of the firms it regulates represent minimum necessary social costs. Since operating cost control is the major public utility regulation problem, this is a serious argument against extending the public utility concept to weapon system production. Moreover, the public regulation system creates an incentive for overinvestment, so that extending the public utility concept would increase the present difficulties of assuring proper capital costs for weapon systems. The basic problems stem not from the basis of the fee, but from the fact that prices are cost-based to begin with.

Public utility regulation is not a remedy for procurement ills. Where, then, should we look? A full answer to this question requires an examination of many more issues than are covered here; nonetheless, one vital point must be made. The appropriate direction for procurement policy is to attempt to design a weapon system acquisition policy that minimizes the need for cost-based prices. The basic procurement problems stem from the need, in a regulatory situation, to use cost as the basis of pricing. Thus, rather than direct our attention at trying to improve

costing techniques or to design new contract provisions, we should be trying to design weapon system acquisition techniques that permit the use of market competition rather than direct regulation to set prices.

Two primary forces lead to a requirement for direct regulation. The first is the difficulty of using competition to select R&D contractors. The second is the necessity of follow-on contracts when the single prime contractor system of organizing weapon system acquisition projects is used. The latter problem seems the most likely candidate for change. There are a number of possible ways of adjusting the organization of contracts to substitute market forces for direct regulation. Examples are: "second-sourcing" as has been applied in some Navy procurements; total program procurements, as applied in the Air Force C-5 program; subcontracting competition, as applied in the Air Force C-141 program; and separation of various stages of programs for contracting purposes. These and other ways of using markets more often than at present merit considerable attention. The best solution to procurement regulation is to minimize the need for it.

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DOCUMENT CONTROL DATA

1 ORIGINATING ACTIVITY THE RAND CORPORATION	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b. GROUP

3. REPORT TITLE

DEFENSE PROCUREMENT AND PUBLIC UTILITY REGULATION

4. AUTHOR(S) (Last name, first name, initial)

Hall, George R.

5. REPORT DATE	6a. TOTAL No. OF PAGES	6b. No. OF REFS.
September 1967	54	---

7. CONTRACT OR GRANT No.	8. ORIGINATOR'S REPORT No.
F44620-67-C-0045	RM-5285-PR

9a. AVAILABILITY/LIMITATION NOTICES	9b. SPONSORING AGENCY
DDC-1	United States Air Force Project RAND

10. ABSTRACT

This study compares the control of procurement prices and profits with the system applied to public utilities. The possible application of public utility regulation to weapon system producers is also considered but rejected. Despite differences in the reasons for regulation and in profit determination, both systems base prices and profits on costs. Since the major procurement problems stem from the cost-based nature of profits, they would not be solved by public utility regulation. Policy emphasis should be on minimizing the need for regulation by encouraging competition through total-program-package procurements, second-sourcing and other atypical acquisition strategies.

11. KEY WORDS

Budgeting
Government
Department of Defense
Military contracts
Procurement
Public utilities
Systems analysis
Weapon systems